ECONOMIC FACTORS AFFECTING WHEAT AREAS WITHIN NEW ZEALAND

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1. INTRODUCTION

1.1 The Problem

A stated objective of the current Government's wheat policy is that New Zealand should be self sufficient in the production of wheat. A means by which this could be achieved is through changes in the announced price for milling quality wheat. This price is currently decided by Government in conjunction with the Wheat Board well in advance of harvest, in fact, prior to sowing.

Historically, the price has often been constant for periods of several years at a time. Also, since World War II the price of wheat has neven fallen below that of the previous year. In contrast, the area of wheat harvested over recent years has been unstable. This instability has made the self-sufficiency objective difficult to achieve and at times it has been necessary to import large quantities of wheat to satisfy domestic demand. An extreme example of the magnitude of this instability is seen in Table 1 where the national and regional areas of wheat threshed in recent years are shown.

Changes in wheat areas over the past 22 years are shown by Chudleigh *et al.* (1978) to be responsible for 86 percent of variation in national wheat production.

TABLE 1

Area of Wheat Harvested ('000 ha)

	Harvest Years			
	1973	1974	1975	1976
New Zealand	107.69	67.41	57.65	103.74
North Island	7.12	3.12	2.70	5.86
Canterbury	76.07	48.84	34.08	66.28
Otago	11.85	7.64	8.48	13.23
Southland	12.64	7.81	12.39	18.37

Source: Department of Statistics

They conclude that further research is necessary to determine the resource costs associated with the present wheat policy of allowing a less stable production but with stable prices. A first stage in such research is to identify and quantify the factors influencing wheat area.

The principal objective of the present study is to measure the major relationships describing the response of wheat area harvested within New Zealand to changes in economic conditions, using an econometric model. This type of model could prove valuable as an aid to policy makers in their attempts to achieve the objectives of a particular wheat industry policy.

1.2 Plan of Study

The following section reviews previous New Zealand studies, while Section 3 explores the particular features of wheatgrowing farming in New Zealand, and discusses the theoretical specifications of the supply response model. Section 4 discusses the estimation method and sources of data. This is followed, in Section 5, with a discussion of results, and, in Section 6, conclusions are summarised.

2. REVIEW OF PREVIOUS STUDIES

The first New Zealand study of wheat supply response is that made by Candler (1957). He attempts to explain the variation in wheat area rather than wheat production, as it is considered that this gives the best estimate of farmers' production intentions and it is these production intentions which provide the main economic content of the supply function. The variables thought to influence wheat area include the fat lamb price, red clover price and area of wheat harvested, all measured in the previous season. Candler's model has been criticized on two major grounds. Firstly, Stewart (1958) states that the red clover price could not have a substantial impact on wheat production because it is a relatively unimportant crop. Secondly, Guise (1968) is critical of the fact that absolute, rather than relative, prices have been used and that the wheat price is not included in the model.

Guise (1968) attempts to explain the area of wheat harvested in New Zealand by extending Candler's approach. The model assumes farmers only partially adjust the actual area of wheat harvested each season towards the desired area of wheat harvested. In such a model it is thought that because of costs involved in changing the wheat area between seasons, the producer cannot fully adjust his actual area to the desired area each season. The resultant distributed lag model is similar to the models discussed by Nerlove (1958a, b), since the desired wheat area and previous season's wheat area become explanatory variables. This desired wheat area is in turn thought to be dependent on farmers' expectations of future prices.

One assumption made by Guise is that the potential area of New Zealand wheat growing land is fixed. A second assumption is that technologies of wheat and sheep farming are changing at a similar rate. Consequently, relative costs of production and levels of physical output associated with these two types of farming remain constant or do not vary appreciably. Economic theory implies that when these two assumptions are valid, the wheat area supply function should be homogenous of degree zero in prices. This means that relative prices, not absolute prices, are the appropriate decision variables.

Guise's results show that significant explanatory variables include the expected price of fat lamb relative to wheat, expected price of small seeds relative to wheat and area of wheat harvested in the previous season. These results suggest that Guise's hypothesis of partial adjustment and the importance of relative prices are at least valid for the period over which the model is estimated, that is 1945 - 1965.

3. MODEL SPECIFICATION

3.1 Regional Responses

The two previous studies implicitly assume that regional wheat supply responses are identical to the national response. This assumption has recently been questioned by Chudleigh, *et al.* (1978) where it is suggested that the Canterbury response is somewhat different from other regions. In Canterbury, there is considerably less variability in wheat area and this variability appears to be decreasing over time as wheat production becomes concentrated on more intensive cropping farms. The model in this study considers the possibility of differing regional supply responses by attempting to estimate, in addition to an aggregate national model, a separate model for each of the four major wheat producing regions. The wheat area harvested is denoted by the vector A, whose ith element , a_i (i = 1, 2, 3, 4, 5) is the area of wheat harvested in the ith district. The districts, or regions included in the model, are New Zealand, North Island, Canterbury (including Nelson and Marlborough), Otago and Southland.

3.2 Economic Influences

The major causes of fluctuations in wheat area suggested by Zwart (1978) are the wide swings in the price of lamb and wool. This suggestion confirms the findings of a recent account analysis summarized in

Table 2 which shows income from wool and sheep are, by far, the largest contributors to gross farm income on those farms that grow wheat. This implies the main alternative activity to wheat growing is sheep farming and, therefore, the associated product prices, that is wool and lamb prices, should have a major influence on the area of wheat threshed.

TABLE 2

Sources of Income on Wheatgrowing Farms

Gross Farm Income	%
Wool	23.1
Sheep	26.1
Cattle	2.2
Wheat	22.2
Barley	5.7
Small Seeds	6.2
Other Crops	10.7
Sundry	4.0
Total	100.0

Source: Agricultural Economics Research Unit, "An Economic Survey of New Zealand Wheatgrowers : Financial Analysis 1977-78." Research Report No. 104, December 1979, Lincoln College.

It is thought that the most important variables which the wheat farmer must consider when deciding the area of wheat to grow, are the expected wheat price, pw*, and the expected prices associated with sheep farming activities, that is the expected fat lamb price, pl*, and the expected wool price pwo*. Thus, initially a general model could be specified as:

(1) $A_t = B_o + B_1\ pw_t^* + B_2\ pl_t^* + B_3\ pwo_t^*,$

where the parameters B_j (j = 0, 1, 2, 3) are the unknown response coefficients for a given region and subscript (t) refers to time period t.

Because all milling quality wheat is sold at prices established well in advance of harvest, in fact prior to sowing, the expected wheat price in period t is known and is taken to be the actual basic wheat price in that same period, pw_t. We follow Guise (1968) in assuming static price expectations regarding lamb, that is the expected price in period t is the lamb price prevailing in the previous season, pl_{t-1}.

It is thought that farmers' expectations toward wool prices are not only affected by the actual wool price in the previous season pwo_{t-1}, but also by the quantity of wool stocks held in the previous season, ws_{t-1}. This relationship results from the fact that in many years, prices that farmers receive have been influenced by the buying and selling activities of wool marketing organizations, especially the New Zealand Wool Commission. For example, given a particular wool price for the previous season, farmers' expectations about wool prices in period t will be higher, if the previous season's wool stocks are relatively low. Equation (1), therefore, can be rewritten as:

$$(2) \quad A_t = B_o + B_1 \; pw_t + B_2 \; pl_{t-1} + B_3 \; pwo_{t-1} + B_4 \; ws_{t-1}.$$

The price of wheat is an example of an absolute price, while the price of wheat deflated by the price index of lamb in an example of a relative price; that is wheat prices are expressed relative to lamb prices. Similarly, the price of wheat deflated by the price index of wool is another example of wheat prices being expressed in relative form.

There has been little fluctuation in the absolute wheat price over the estimation period because since World War II the price of wheat has never fallen below that of the previous year and it has been constant for periods of several years. This suggests that statistically changes in the absolute wheat price has little impact on the wheat area. However, the relative wheat prices have varied considerably. By measuring the effect of changes in the relative wheat price it is possible to derive an estimate of how the wheat area has responded to changes in the absolute price. This information is important if the model is to be used to simulate the impact of larger changes in the wheat price than has occurred in the past.

Therefore an alternative specification of equation (2) would be to express the price variables in ratio form, that is:

$$(3) \quad A_t = B_o + B_1 \ (pw_t/pl_{t-1}) + B_2 \ (pw_t/pwo_{t-1}) + B_3 \ ws_{t-1}.$$

This form of model specification conforms with that which would be derived from neoclassical production theory under assumptions of fixed resource supplies and constant technology. That is, the potential area of wheat growing land is assumed fixed and the technologies of wheat and sheep farming are thought to be changing at similar rates.

The model given by equation (3) excludes the previous season's wheat area as an explanatory variable, thus implying that farmers do not just partially adjust but rather they fully adjust their wheat areas to changing economic conditions. It is not clear *a priori* if this specification is valid and so a second, possible model includes the previous season's wheat area as an explanatory variable, that is:

$$(4) \quad A_t = B_o + B_1 \ (pw_t/pl_{t-1}) + B_2 \ (pw_t/pwo_{t-1}) + B_3 ws_{t-1} + B_4 A_{t-1}$$

3.3 Climatic Influences

The most important meteorological influence on the area of wheat harvested is thought to be excessive rainfall at that time when wheat is normally sown. This excessive rainfall can cause wheat sowing to be delayed to the extent where some farmers are forced to give up attempting to sow wheat for that particular year. A recent survey[1] shows that average sowing dates vary considerably between regions. For example, on North Island and Southland farms, wheat is almost exclusively a spring sown crop with the average sowing date being the last week in September. In contrast, wheat is mainly an autumn sown crop in Canterbury.

Aggregate time series data on excessive rainfall weighted by the importance of the different wheat areas are available for New Zealand in aggregate but not for the four separate areas within New Zealand. A simplifying assumption is, made, therefore that excessive rainfall within the four areas of New Zealand is proxied by excessive national rainfall figures over the period July to October. It is not known *a priori* whether excessive rainfall at sowing, r_{t-1} has a significant effect on wheat area harvested in period t and so a third possible model has included this climatic factor as an explanatory variable. That is:

$$(5) \quad A_t = B_o + B_1(pw_t/pl_{t-1}) + B_2(pw_t/pwo_{t-1}) + B_3 ws_{t-1} + B_4\, r_{t-1}$$

Therefore the three basic models are given by equations (3),(4) and (5)

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1 Agricultural Economics Research Unit, "An Economic Survey of New Zealand Wheatgrowers Enterprise Analysis 1978-79, Survey No. 3." Research Report No. 101, October 1979, Lincoln College.

4. ESTIMATION METHOD AND DATA SOURCES

The equations of the different models involve unknown parameters, B_j, (j = 0, 1, 2, 3, 4) to be estimated so an additive error term assumed to possess the classical properties of normality, serial independence, and constant variance is introduced into each equation. Each equation is then estimated separately using the method of ordinary least squares.

Annual data for all variables, except excessive rainfall are obtained for the period 1953 to 1976. It is possible to obtain excessive rainfall data only back to 1960. The data are represented in Appendix A.

Data on the areas of wheat harvested are obtained from the New Zealand Department of Statistics while the announced wheat price is obtained from the New Zealand Wheat Board. These data series are recorded by harvest years.

Averages of the mid monthly lamb schedule prices from November to April inclusive are used to calculate the per head lamb price. The price assumes a lamb weight of 13.6 kilograms, and a wool pull of 1 kilogram. Up to 1966 these data were obtained from the New Zealand Meat Producer Board's Annual Reports. In later years they obtained from the Annual Review of the Sheep and Beef Industry published by the New Zealand Meat and Wool

Board's Economic Service. The wool price used is the average New Zealand auction greasy wool price obtained from the Annual Review of the Sheep and Beef Industry. These data series refer to the year ending 30 June.

The wool stock data is the New Zealand Wool Commission stocks in the United Kingdom and New Zealand at July 1st as reported in the New Zealand Wool Commission Report and Statement of Accounts and more recently in Wool News published by the New Zealand Wool Board.

Rainfall data available from the New Zealand Meteorological Service are expressed as a "percent of normal" where normal is defined as average rainfall over 1941 to 1970. Excessive rainfall is, therefore, defined as rainfall exceeding normal.

5. RESULTS

5.1 Choice of Model

It is obvious from the model specification section that many different variations of the three basic models are possible. Early in the analysis it became apparent that those models which assumed complete area adjustment were superior, over the period considered, to models that used partial area adjustment. Therefore, subsequent analysis was confined to those models that assume complete area adjustment, that is equations (3) and (5).

The problems of auto-correlation are overcome by using the first differences of the original data. This transformation does not greatly affect the interpretation of the models but it does improve the statistical properties of the model.

The model which has the best statistical fit over the period 1960 to 1976, is of the following general form:

$$(6) \quad \Delta A_t = B_0 + B_1 \Delta (pw_t/pl_{t-1}) + B_2 \Delta (pw_t/pwo_{t-1}) + B_3 \Delta ws_{t-1} + B_4 r_{t-1}.$$

The explanatory power of this model, however, is still disappointing, and an examination of the graph of residuals would suggest a model specification in which the excessive rainfall variable is replaced by a dummy variable, r^d which has a value of 1 for the 1975 harvest year.

In this particular harvest year, excessive rainfall at drilling had a dramatic impact on the area of wheat drilled in Canterbury and North Otago where a large proportion of the nation's wheat is grown. In contrast, the Southland weather at drilling was dry and warm causing an increased area of wheat to be sown in this area. Thus the dummy variable indicates an excessively wet drilling period in all areas except Southland where it represents favourable climatic conditions at drilling.

The explanatory power of this dummy variable model, relative to the previous model which had excessive rainfall as an explanatory variable, is an improvement for all districts except the North Island where it remained constant. Therefore, the following results are based on the dummy variable specification of equation (6) in which r^d replaces r_{t-1}, and the equation is estimated over the period 1953 to 1976.

5.2 Parameter Estimates

Table 3 reports estimates for the five equations of the unknown parameters over the period 1953 to 1976. Standard errors associated with the parameters are shown in brackets. The associated coefficient of multiple correlation adjusted for degrees of freedom, $\bar{R}$, and Durbin Watson Statistics, d, are also given.

TABLE 3

Parameter Estimates

	North Island	Canterbury	Otago	Southland	New Zealand
Constant	-0.007	1.220	-0.079	0.164	1.456
<u>Explanatory Variables</u>					
$\Delta(pw_t/pl_{t-1})$	0.054 (0.024)	0.551 (0.006)	0.045 (0.027)	0.073 (0.028)	0.725 (0.106)
$\Delta(pw_t/pwo_{t-1})$	0.014 (0.022)	0.190 (0.062)	0.062 (0.025)	0.038 (0.025)	0.306 (0.099)
Δws_{t-1}	0.004 (0.001)	0.007 (0.005)	0.008 (0.002)	0.009 (0.002)	0.029 (0.008)
r^d	-1.780 (1.412)	-29.965 (3.853)	-1.587 (1.577)	2.082 (1.654)	-32.242 (6.181)
$\bar{R}^2$	0.50	0.90	0.71	0.76	0.90
d	2.34	1.71	1.81	2.34	1.78

An examination of Table 3 shows that changes in the wheat price deflated by both the fat lamb price and wool price have large positive influences on the area of wheat harvested in New Zealand, especially in Canterbury. This is to be expected as Canterbury is the largest wheat producing area in New Zealand.

Increases in wool stocks cause an increase in the area of wheat threshed, which is consistent with the hypothesis embedded in the model; that increases in wool stocks causes farmers' wool price expectations to decrease and, therefore, wheat farming becomes a relatively more profitable activity than sheep farming. The excessively wet drilling period associated with the 1975 harvest year is seen to have had an adverse effect on the amount of wheat harvested in all regions except of course Southland where it caused an increase in the area of wheat harvested.

Therefore all the estimated parameters have signs that are consistent with the economic theory and the climatic hypothesis embedded in the model. In addition, the parameters are all statistically satisfactory except those associated with the lamb price and wool price in the North Island equation.

5.3 Elasticities

Reported in Table 4 are estimates of the wheat area response elasticities with respect to the current season's wheat price, previous season's fat lamb price, previous season's wool price, and previous season's wool stocks. The way in which expectations have been specified in this study imply that an alternative explanation of this table is that it reports estimates of the wheat area response elasticities with respect to the expected wheat price. expected fat lamb price, expected wool price and expected wool stocks.

These elasticities indicate the direct response of wheat area to changes in these variables and are calculated by using sample mean values for the variables. The signs of these elasticities are consistent with the signs on the corresponding parameters of the estimated equations and hence are consistent with economic theory as discussed already.

TABLE 4

Wheat Area Elasticities

	North Island	Canterbury	Otago	Southland	New Zealand
Explanatory Variables					
pw_t	0.864	0.901	0.575	0.667	0.828
pl_{t-1}	-0.692	-0.678	-0.258	-0.446	-0.590
pwo_{t-1}	-0.171	-0.223	-0.340	-0.221	-0.234
ws_{t-1}	0.100	0.016	0.089	0.107	0.046

The elasticities associated with the wheat price and wool price for the North Island are to be regarded with caution because they are calculated using the parameter estimate of the wheat price relative to the wool price, which is statistically insignificant as seen in Table 3.

All elasticities are inelastic and each set of elasticities associated with a particular explanatory variable are relatively stable across districts. For all districts the price variable exhibiting the largest elasticity is wheat price. For example, it is estimated that a 1 percent increase in the wheat price will result in a 0.82 percent increase in the area of wheat threshed in New Zealand. It is estimated that a 1 percent decrease in the fat lamb price will result in a 0.59 percent increase in the national area of wheat harvested in the following season and that a 1 percent decrease in the wool price will result in a 0.23 percent increase in the national area of wheat harvested in the following season. These results may be compared with those of Guise (1968), who also obtains inelastic short run price responses for wheat and fat lamb.

5.4 Model Validation

A necessary prerequisite, before any model can be used for any forecasting or policy analysis study, is for it to be satisfactorily validated. Validation checks have been carried out only on the New Zealand model. The validation ensures that the model has the ability to explain both past changes in the area of wheat as well as possible changes in the future. The two checks carried out include an investigation, first of the model's structural stability through time, then of the model's ability to forecast wheat area one year ahead.

To determine the structural stability through time, the New Zealand model is re-estimated using a smaller number of observations. It is arbitrary as to how many observations are used, so the periods 1960 to 1976 are chosen and the changes in coefficients are tested for significance using an F statistic. This statistic examines the sum of the residuals denoted by Σe, and is given by:

$$F = ((\sum_{i=1}^{23} e_i^2 - \sum_{i=1}^{16} e_i^2)/7)/(\sum_{i=1}^{16} e_i^2/11),$$

on 7, 11 degrees of freedom.
The results are shown in Table 5 where it is seen that the F statistic is non significant indicating that in aggregate, parameter estimates do not change significantly as the sample size decreases from 23 to 16 observations.

There is no unique way of examining the ability of the model to forecast the area of wheat harvested one year ahead. A common approach is to visually examine the graph of wheat area forecasted relative to actual wheat area. This can be done, using Figure 1. First the model forecasts wheat area harvested within the sample period in which the model is estimated, that is 1953 to

TABLE 5

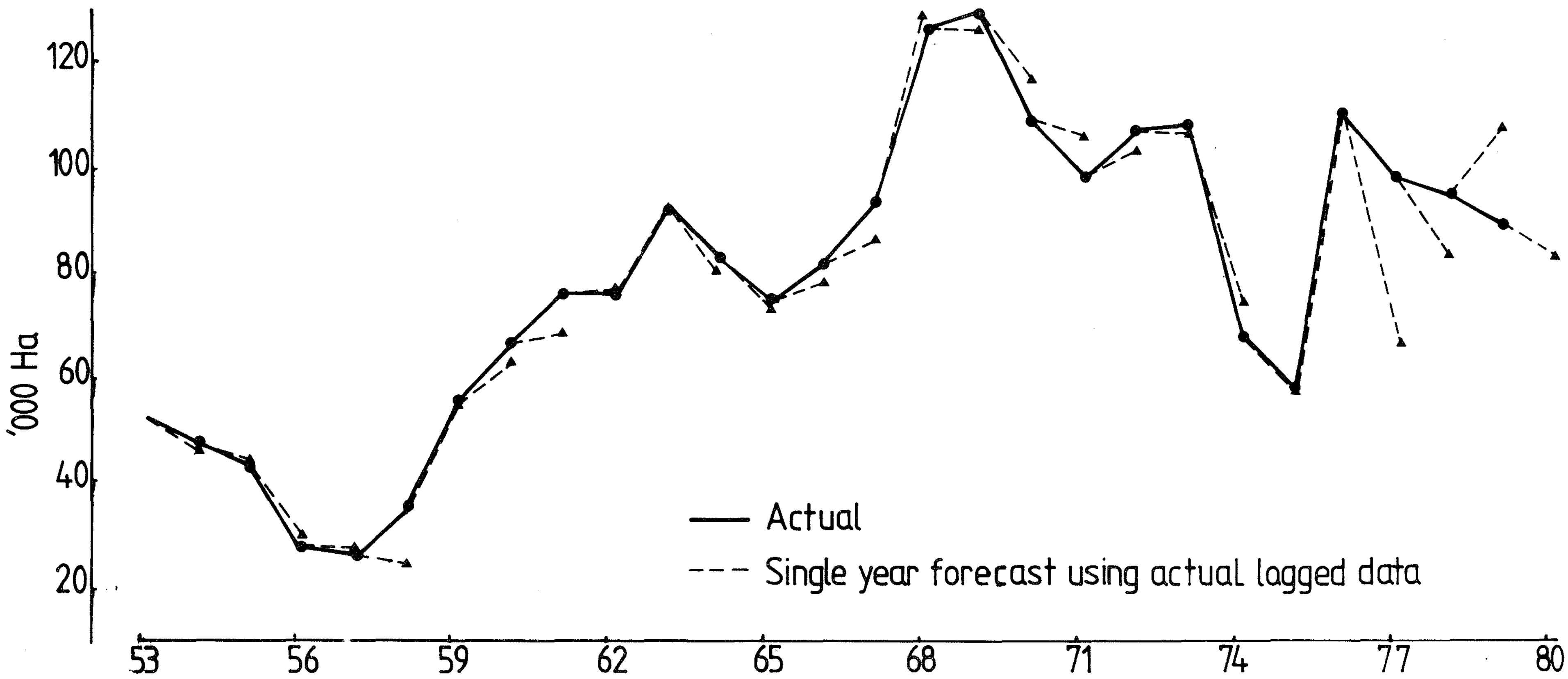
Structural Stability of Model

	New Zealand	
n	23	16
constant	1.45	1.77
Explanatory Variables		
$\Delta(pw_t/pl_{t-1})$	0.72	0.68
$\Delta(pw_t/pl_{t-1})$	0.30	0.33
Δws_{t-1}	0.02	0.02
r^d	-31.24	-31.60
Σe^2	601.47	366.61
F	1.0	

1976. It is seen that the forecasts are close to the actual area of wheat harvested and that most of the turning points are forecasted.

An alternative but far more rigorous method is to forecast observations ahead of the sample period, which in this study is 1977 to 1979. It is seen in Figure 1 that in 1977 and 1978 the model correctly forecasts a decrease in wheat area, but a larger decrease than that which actually occurred especially in the 1977

Figure 1: Area of wheat harvested in New Zealand



harvest year. It appears that the model's reaction to changing economic circumstances outside the sample period is too responsive. This suggests a structural change has occurred in the years outside the sample period which has not been allowed for in the model. A possible explanation is, that in recent years machinery costs associated with wheatgrowing have escalated and this has caused farmers to grow wheat on a more regular basis in an effort to make more use of their high cost machinery.

For the 1979 harvest year the economic indicators, given in Appendix A, suggest an increase in the area of wheat harvested. This is because the lagged lamb price per head declined from \$13.86 to \$12.66, the lagged wool price per kilogram declined from 219 cents to 190 cents and the announced basic wheat price per tonne increased from \$120 to \$127.50. In contrast, a decrease in area of wheat harvested actually occurred. The reason for this decrease was the adversely wet climatic conditions prevailing about drilling time in 1978.

The model's structural stability and ability to forecast one year ahead within the sample period, is good. When it comes to forecasting outside the sample period the model is less satisfactory, however it does forecast two out of three turning points. Therefore, if the simplifying assumptions underlying the model are properly understood the model could be a useful aid in forecasting and policy analysis work.

5.5 A Forecast for 1980

In both national and regional models, data on independent variables are identical while data on dependent variables are internally consistent. That is, the sum of the four regional wheat areas harvested equals the national wheat area harvested. Therefore, the sum of the forecasted regional changes in wheat area harvested will equal the forecasted national change in wheat area harvested. This fact implies that either method can be used to forecast the area of wheat harvested in New Zealand for the 1980 harvest year.

A point forecast is obtained by substituting the available data into the estimated New Zealand part of equation (6), specified in dummy variable form, as given in Table 3. This results in the forecasted area of wheat harvested in 1980 to be 7,000 hectares less than 1979; that is a reduction of 7.8 percent.

This forecast should be treated with caution given that the model does not treat climate as a significant annual explanatory variable and that farmers may be only partially responding to changing economic conditions during the year.

6. CONCLUSIONS

In this paper we have attempted to update the wheat area forecasting model developed by Guise (1968). Unlike Guise's study however, the expected price of small seeds relative to wheat is not included in the model specification and the area of wheat harvested in the previous season is not found to be a significant variable for the sample period 1953 to 1976.

Instead the significant variables are the wheat price relative to the previous season's fat lamb price index, wheat price relative to the previous season's wool price index and the previous season's wool stocks. An allowance is also made, using a dummy variable for the adverse climatic conditions when the 1975 harvest was being drilled. An attempt is also made to estimate a separate model for each of the four major wheat producing regions as well as for New Zealand as a whole.

It is found that supply responses differ within regions especially with respect to prices. Surprisingly the region which appears to be most responsive to prices is Canterbury, although this suggestion is not conclusive because the explanatory power of each model differs. Parameter estimates for all regions except the North Island are statistically satisfactory and consistent with the economic theory and climatic hypothesis embedded in the model. All elasticities were inelastic and each set of elasticities associated with a particular explanatory variable were relatively stable across regions.

Although the model satisfactorily explains the area of wheat harvested during the sample period, it does not explain adequately what happened in 1977 to 1979. This would suggest that a structural change has been occurring in recent years. Possible reasons for this change have been suggested and an allowance for these should be made in any updating of this model.

Another possible improvement is to more satisfactorily quantify the effect that climate, especially at drilling time, has on the area of wheat harvested. This would involve first studying the effect the components of climate, such as rainfall, temperature, sunshine hours and soil moisture have on the area of wheat harvested in a more detailed way than has been attempted in this paper.

It is thought the model could be a useful aid in further forecasting and policy analysis work, if used with an appreciation of its simplifying assumptions. For the 1980 harvest year, relative to 1979, the model forecasts a 7,000 hectare (7.8 percent) decline in wheat area harvested.

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APPENDIX A

TABLE 6

Area of Wheat Harvested ('000 ha)

Harvest Year	New Zealand a_1	North Island a_2	Canterbury a_3	Otago a_4	Southland a_5
1953	51.49	3.96	35.68	6.27	5.58
1954	46.06	2.68	31.47	6.93	4.98
1955	42.08	2.78	29.54	5.63	4.12
1956	27.71	1.82	18.90	4.43	2.56
1957	26.61	1.91	17.18	4.32	3.20
1958	33.97	2.11	22.08	5.15	4.63
1959	53.79	3.85	36.33	7.62	5.97
1960	66.03	4.61	46.06	9.19	6.17
1961	75.59	4.64	52.74	10.72	7.49
1962	75.39	4.27	51.83	11.20	8.08
1963	91.36	5.23	61.28	13.81	11.04
1964	82.54	4.49	54.41	12.74	10.91
1965	74.45	5.21	49.20	10.61	9.42
1966	80.75	5.12	52.39	12.62	10.61
1967	93.31	4.81	61.82	14.02	12.66
1968	126.65	8.75	77.71	19.92	20.28
1969	129.98	11.26	77.87	21.24	19.61
1970	108.40	9.30	70.19	13.96	14.94
1971	97.53	6.45	65.77	12.85	12.45
1972	106.59	4.62	72.04	13.56	16.38
1973	107.69	7.12	76.07	11.85	12.64
1974	67.41	3.12	48.84	7.64	7.81
1975	57.55	2.70	34.08	8.48	12.39
1976	103.74	5.86	66.28	13.23	18.37
1977	96.20				
1978	94.46*				
1979	89.27*				

* Provisional

TABLE 7

Explanatory Variables

Harvest Year	Wheat Price pw_t	Lamb Price pl_t	Wool Price pwo_t	Wool Stocks ws_t	Excessive Rainfall r_t
	$/Tonne	$/Head	c/kg	'000 Bales	Normal = 4
1953		4.89	84.85	-	
1954	42.26	5.14	92.31	-	
1955	42.26	6.08	91.25	-	
1956	42.26	5.81	84.85	0.019	
1957	42.26	5.98	100.53	-	
1958	42.26	5.27	75.61	46.899	
1959	49.60	4.79	66.36	48.089	
1960	49.60	4.21	82.00	0.415	4.00
1961	49.60	4.42	74.10	1.932	4.65
1962	49.60	3.47	72.10	0.121	4.00
1963	49.60	4.17	78.70	-	5.51
1964	49.60	4.83	101.20	0.002	4.00
1965	49.60	5.71	77.40	1.556	4.00
1966	53.28	5.33	76.50	0.053	4.00
1967	53.28	4.31	64.60	645.543	4.00
1968	53.28	5.28	50.50	687.827	4.00
1969	53.28	5.68	61.90	480.074	4.20
1970	53.28	6.02	56.40	350.579	4.41
1971	53.28	5.78	53.40	262.741	4.00
1972	55.12	5.04	66.50	69.664	4.39
1973	56.95	9.27	144.00	-	4.39
1974	59.71	10.02	139.20	19.761	5.50
1975	91.66	6.47	91.70	213.088	5.35
1976	102.88	9.86	157.10	49.961	
1977	110.00	13.86	219.50	65.294	
1978	120.00	12.66	190.40	118.209	
1979	127.50	14.82	218.80	40.894	
1980	137.00*				

* Provisional